

Air and Space Natural Environment Modeling and Simulation Executive Agent



INTEGRATED NATURAL ENVIRONMENT AUTHORITATIVE REPRESENTATION PROCESS (INEARP)

**Steve Lowe – AER, Inc.
ESG Development Lead**

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 13 MAR 2008		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Integrated Natural Environment Authoritative Representation Process (INEARP)				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) AER, Inc.				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES 2008 DoD M&S (Modeling and Simulation) Conference, presentations held in Orlando, Florida on March 10 - 14, 2008, The original document contains color images.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 16	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



Motivation



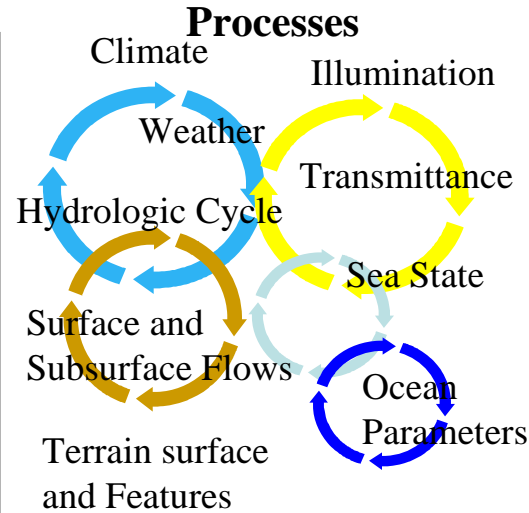
- In many cases, a simulation's fidelity depends on interaction with the environment
 - Aircraft tactics based on clouds and visibility
 - Naval tactics based on acoustic performance
 - Troop movement rate determined by ground wetness
- Environment must be realistic and consistent
 - Should see ground get wet if it rains
 - Should see ocean response to high winds



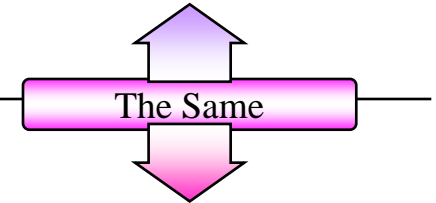
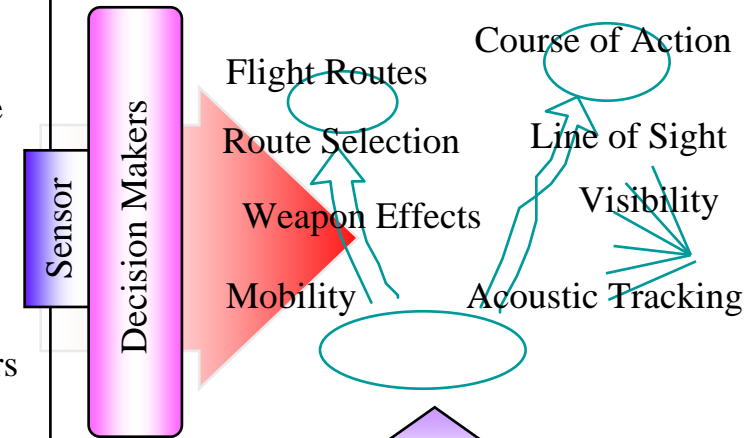


Integrated Natural Environment

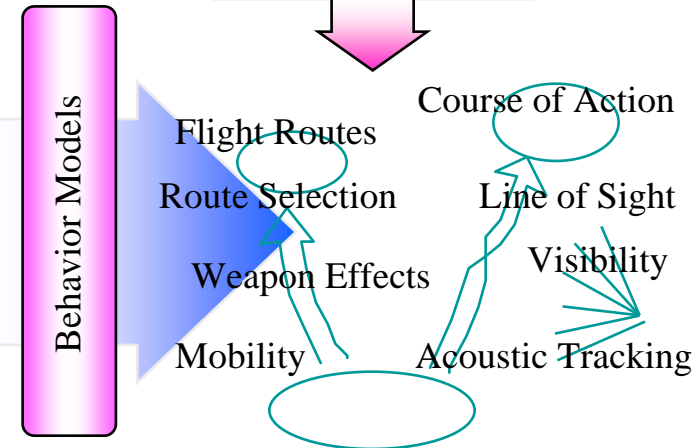
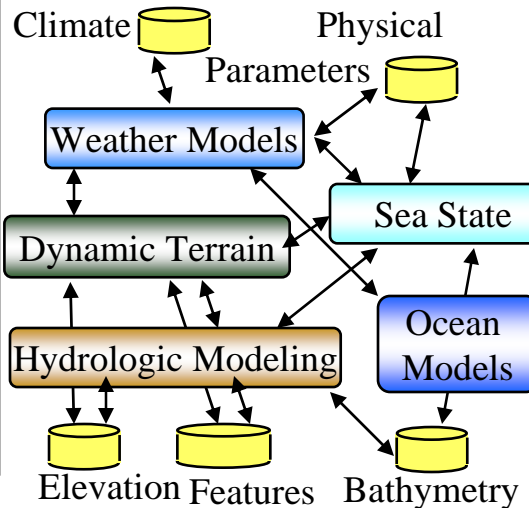
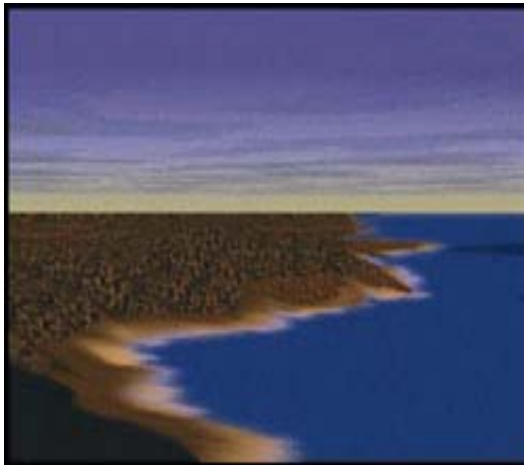
Natural



System Performance



Synthetic



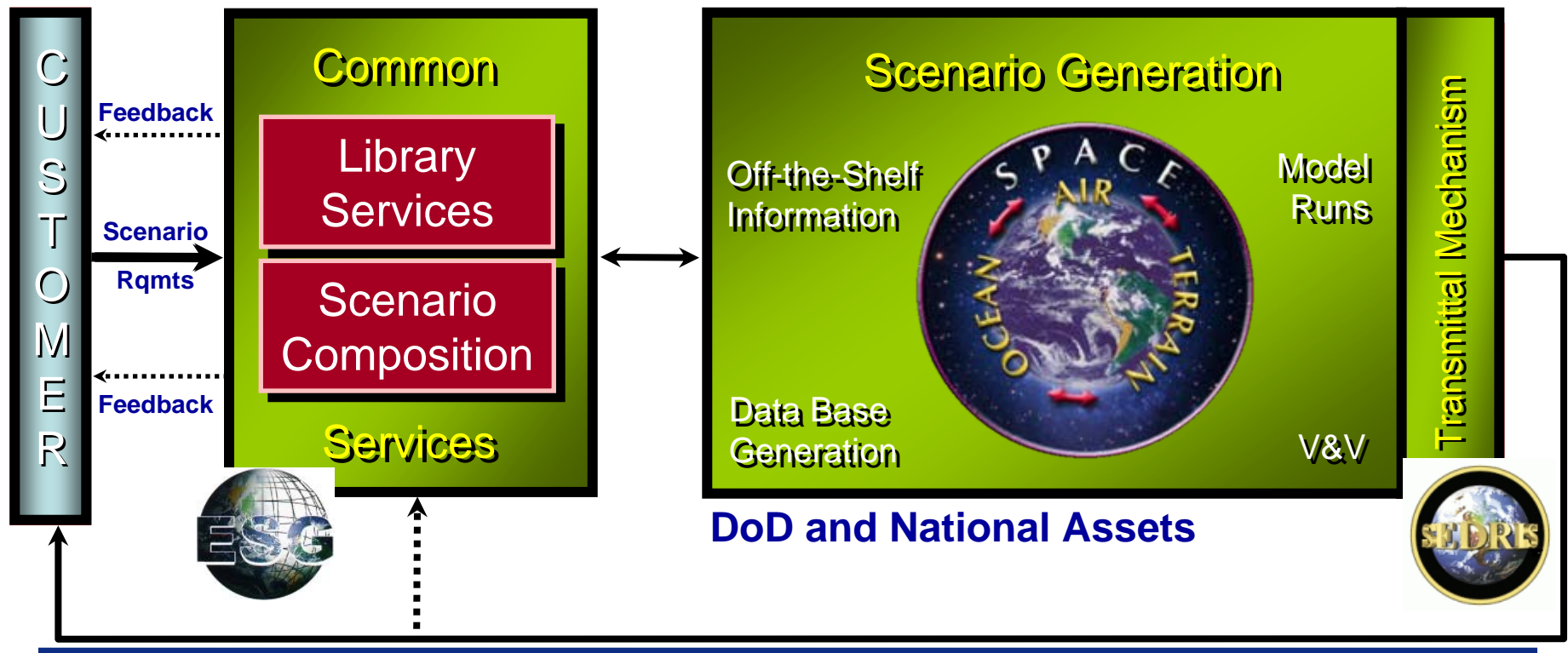


INEARP: A Strategy and Process Model for Environment Support M&S

Integrated Natural Environment Authoritative Representation Process (INEARP)

The Challenge

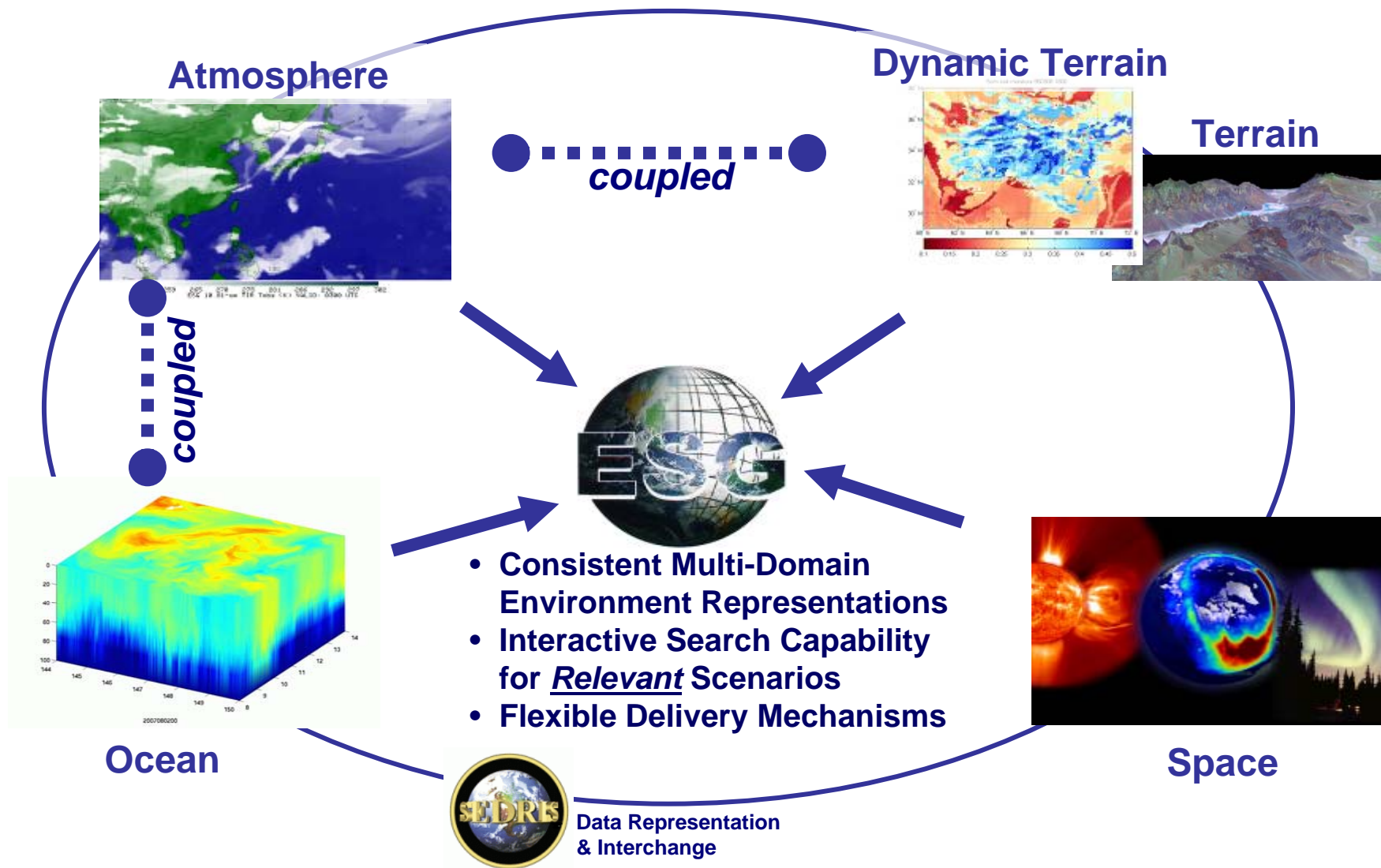
Create a physically consistent, cross-domain authoritative “ground truth” environment representation that meets user requirements.





Environmental Scenario Generator

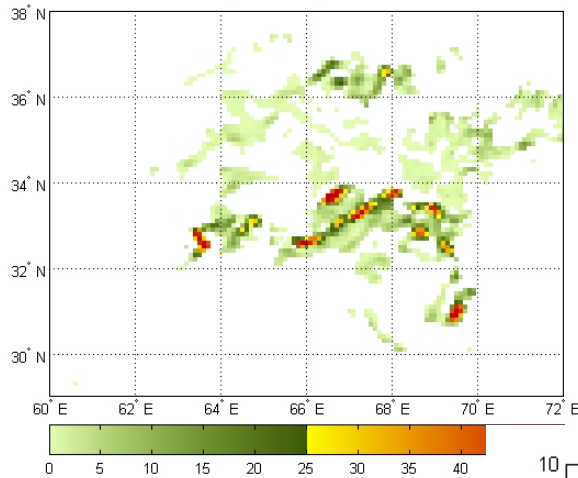
Key Enabling Technology for the INEARP



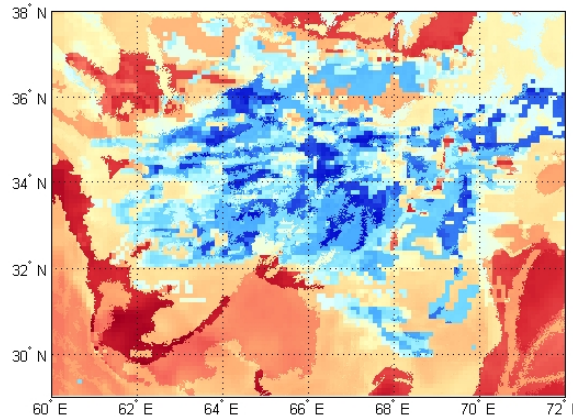


Atmosphere - Terrain Coupling

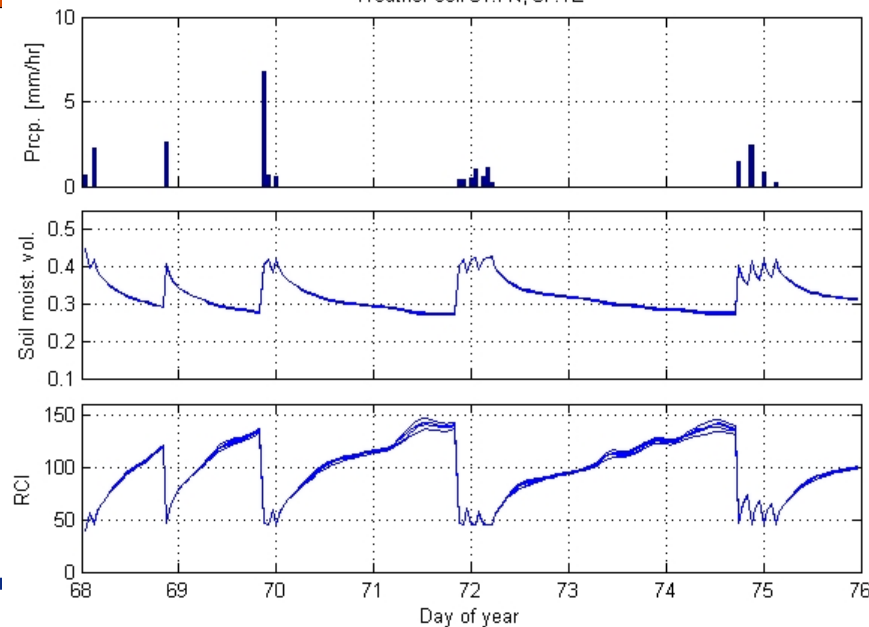
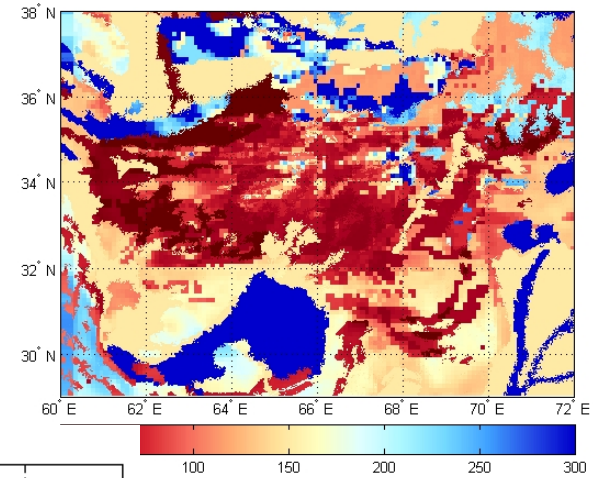
Precipitation Field



Dynamic Soil Moisture

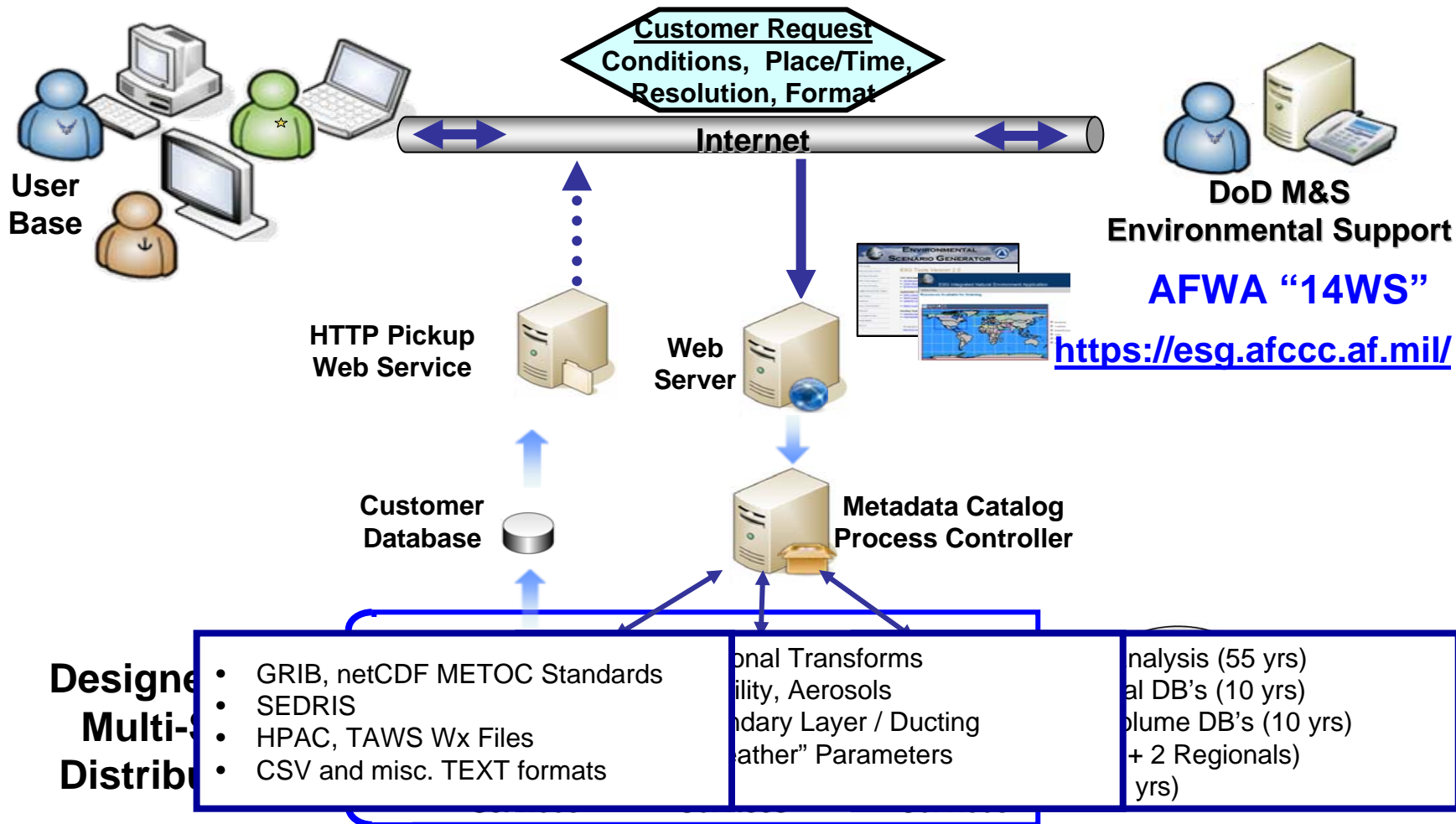


Dynamic Soil Cone Index

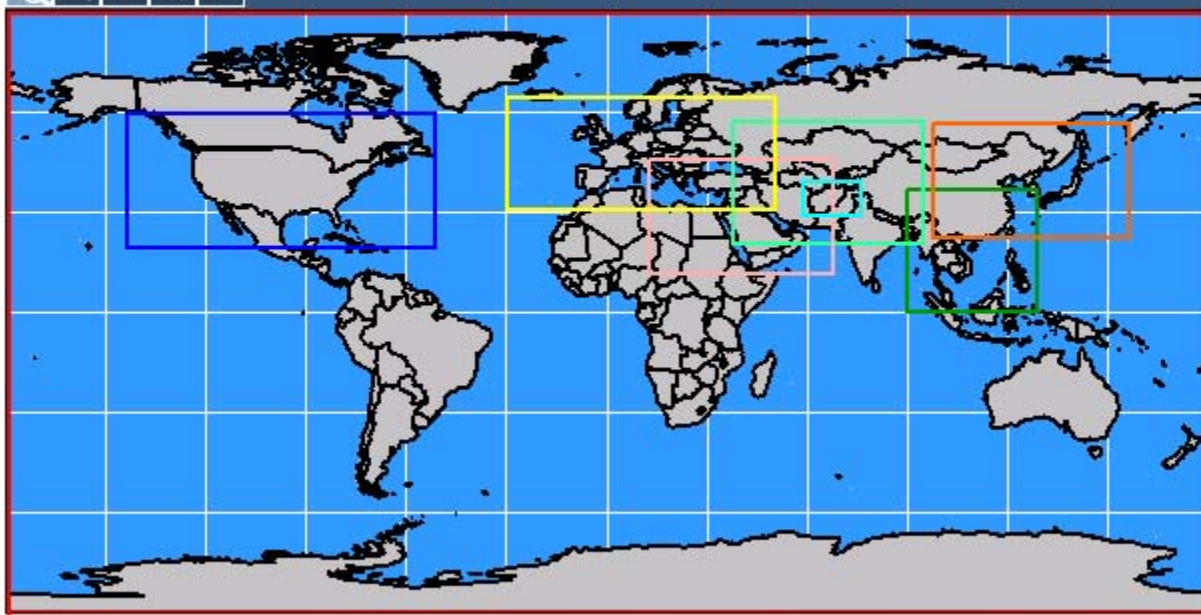




ESG Conceptual Architecture



AFWA "14WS"
<https://esg.afccc.af.mil/>



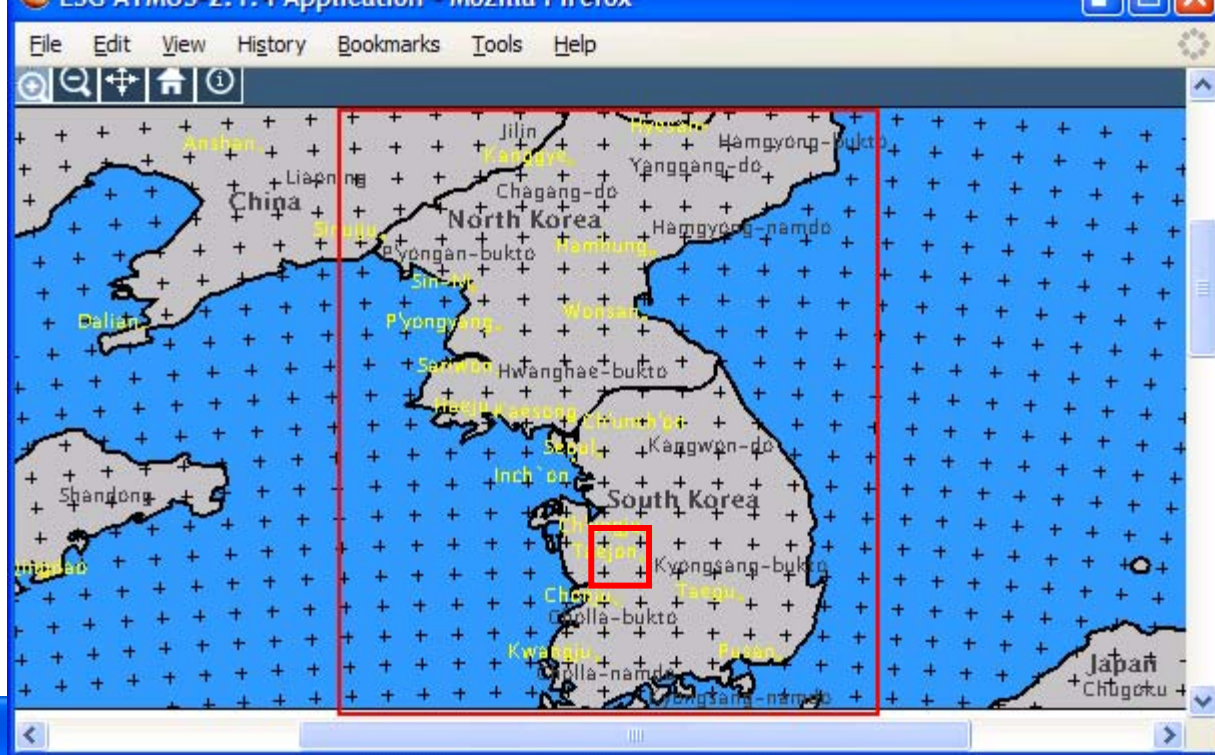
- ☒ WorldGrid
- ☒ Countries
- ☒ States/Provinces
- ☒ Cities
- ☒ Rivers
- ☒ Lakes

Atmosphere Resources

<input type="radio"/>	■ NCEP/NCAR Reanalysis	✓	01/01/1950 - 06/30/2006	6 hours	2.5 deg
<input type="radio"/>	■ ACMES CASIA	✓	10/01/1986 - 09/30/1996	1 hour	40 km
<input type="radio"/>	■ ACMES IRAQ	✓	10/01/1986 - 09/30/1996	1 hour	40 km
<input type="radio"/>	■ ACMES KOR4	✓	10/01/1986 - 09/30/1996	1 hour	40 km
<input type="radio"/>	■ ACMES SEAS2	✓	10/01/1986 - 09/30/1996	1 hour	40 km
<input type="radio"/>	■ ACMES EUROPE	✓	10/01/1986 - 09/30/1996	1 hour	40 km
<input type="radio"/>	■ ACMES Conus3	✓	10/01/1986 - 09/30/1996	1 hour	40 km
<input type="radio"/>	■ ACMES CASIAB	✓	10/01/1986 - 09/30/1996	1 hour	10 km

Space Resources

<input type="radio"/>	■ Space Weather Global Derived Indices	✓	01/01/1991 - 12/31/2002	1 hour	0.0 deg
<input type="radio"/>	■ Space Weather Global Observed Indices	✓	01/01/1991 - 12/31/2002	1 hour	0.0 deg

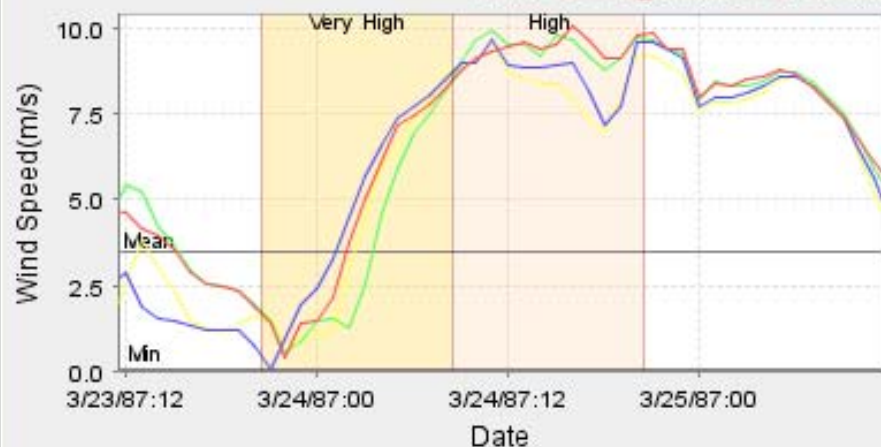


- Mozilla Firefox

s Tools Help

Add Segment				Delete Segment >				Delete Segment <			
Segment Duration: 12 Hour v				Segment Duration: 12 Hour v							
Criteria	Operator	T1	T2	Operator	T1	T2					
Temperature(F) @ Surface	Very High v	0.0	0.0	Low v	0.0	0.0	<input type="checkbox"/>	<input type="checkbox"/>			
Total Cloud Cover(%) @ Surface	Any Value v	0.0	0.0	Any Value v	0.0	0.0	<input type="checkbox"/>	<input type="checkbox"/>			
Wind Direction(degTrue) @ Surface	t1 < Parm < t2 v	180.0	270.0	t1 < Parm < t2 v	270.0	360.0	<input type="checkbox"/>	<input type="checkbox"/>			
Wind Speed(m/s) @ Surface	Very High v	0.0	0.0	High v	0.0	0.0	<input type="checkbox"/>	<input type="checkbox"/>			

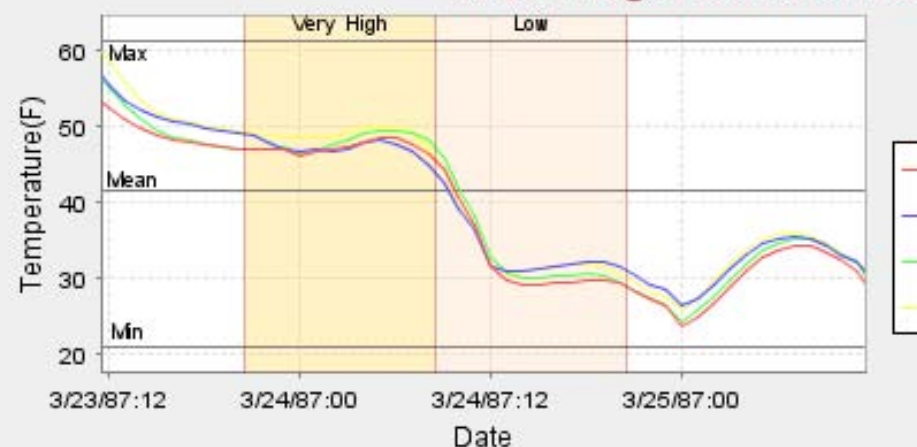
Wind Speed@Surface of Ground



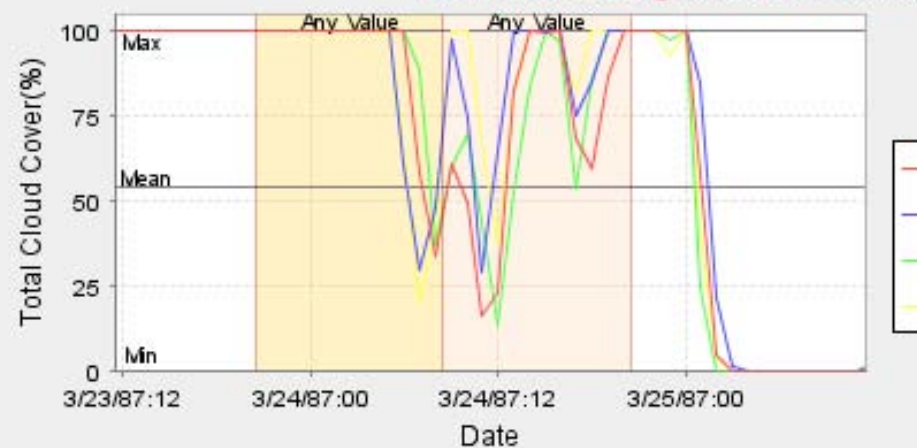
Wind Direction@Surface of Ground



Temperature@Surface of Ground/S

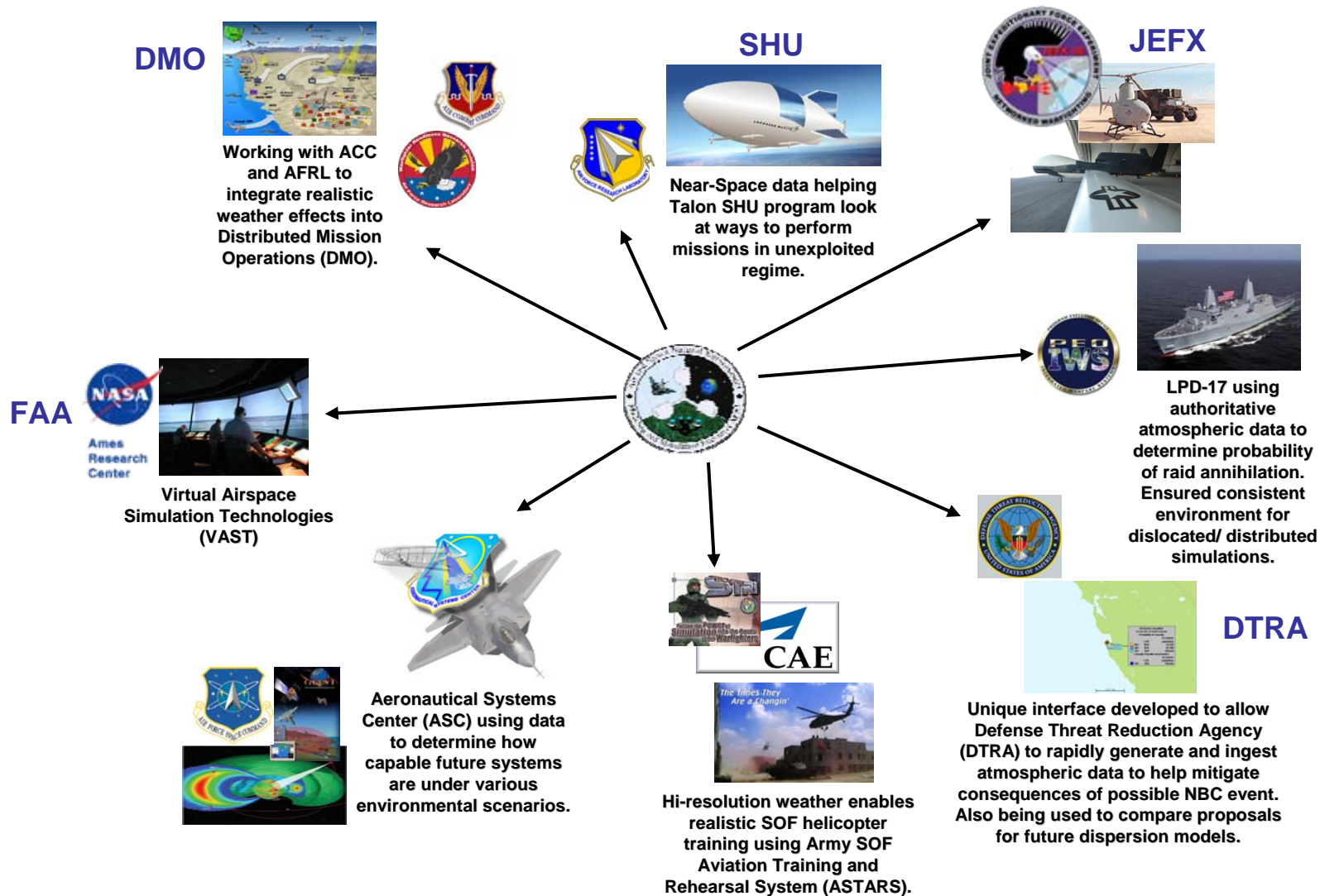


Total Cloud Cover@Surface of Ground





Programs Leveraging the INEARP

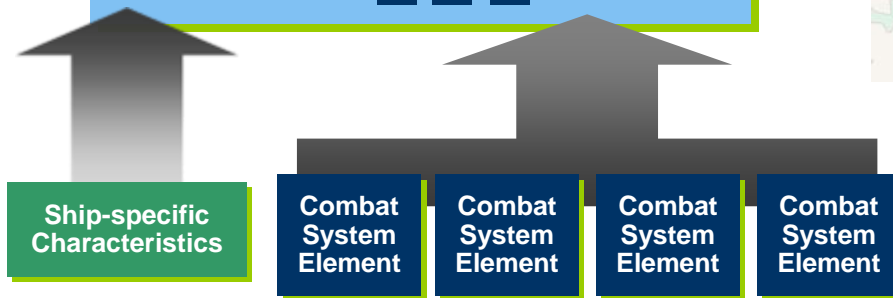
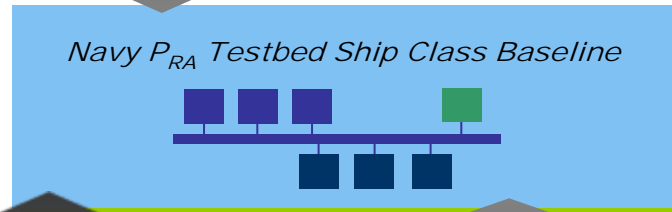




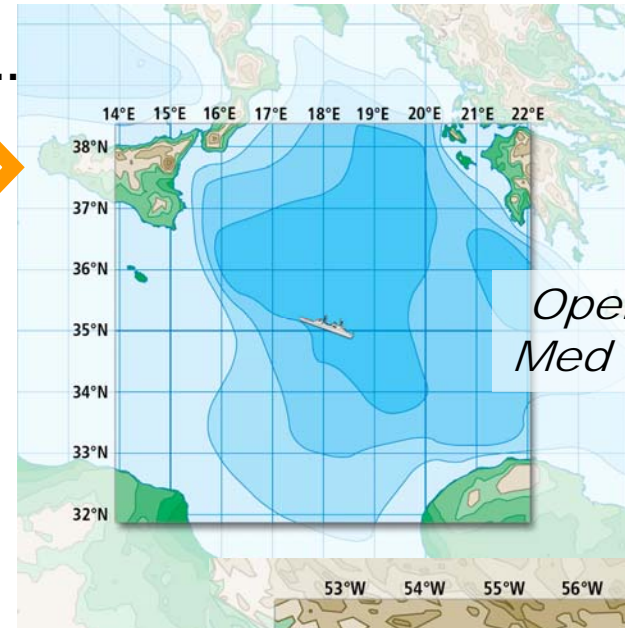
PEO/IWS Enterprise P_{RA} Testbed

“Virtual Range”

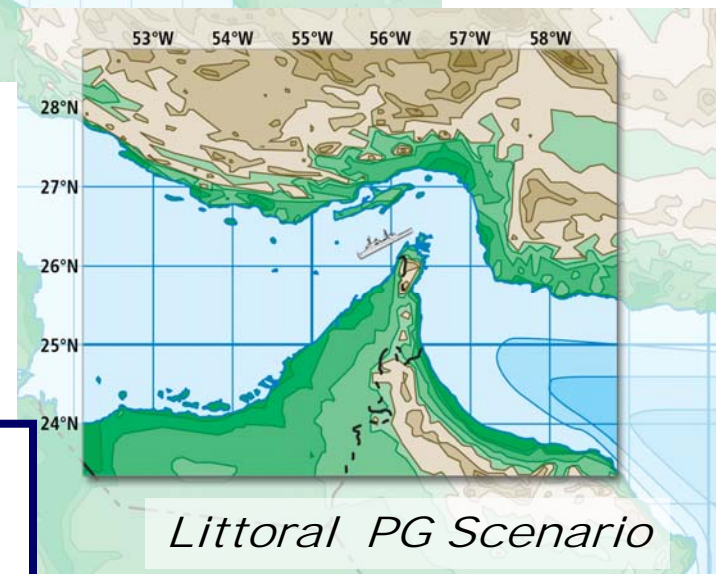
Obtained from ESG ..



“Virtual Test Ship”



*Open Ocean
Med Scenario*



Littoral PG Scenario

RDML Frick: “Thanks to ESG technology... for datasets to meet specified conditions...(program) lifetime cost avoidance \$50M!”



INEARP Program

- **Three-Year effort (FY-08 is year two) sponsored by the Acquisition community via the M&S Coordination Office**
 - **Sponsor: Mr. Dipetto**
 - **Oversight: Mr. Lewis, DoD ASNE MSEA**
 - **Performance: AER, Inc.**

- **FY-08 Funded Development Initiatives**
 - **Working with NGDC on remote access to Space resources**
 - **Integration of higher-res atmospheric data archives (ERA-40) and modeling capabilities (WRF)**
 - **Standup of SIPRNET site**
 - **Upgrade of SEDRIS capabilities per FCS requirements**
 - **Expanded Web Service capabilities**

JOINT END-TO-END PROGRAM

“A Factory to Foxhole Process”

#1

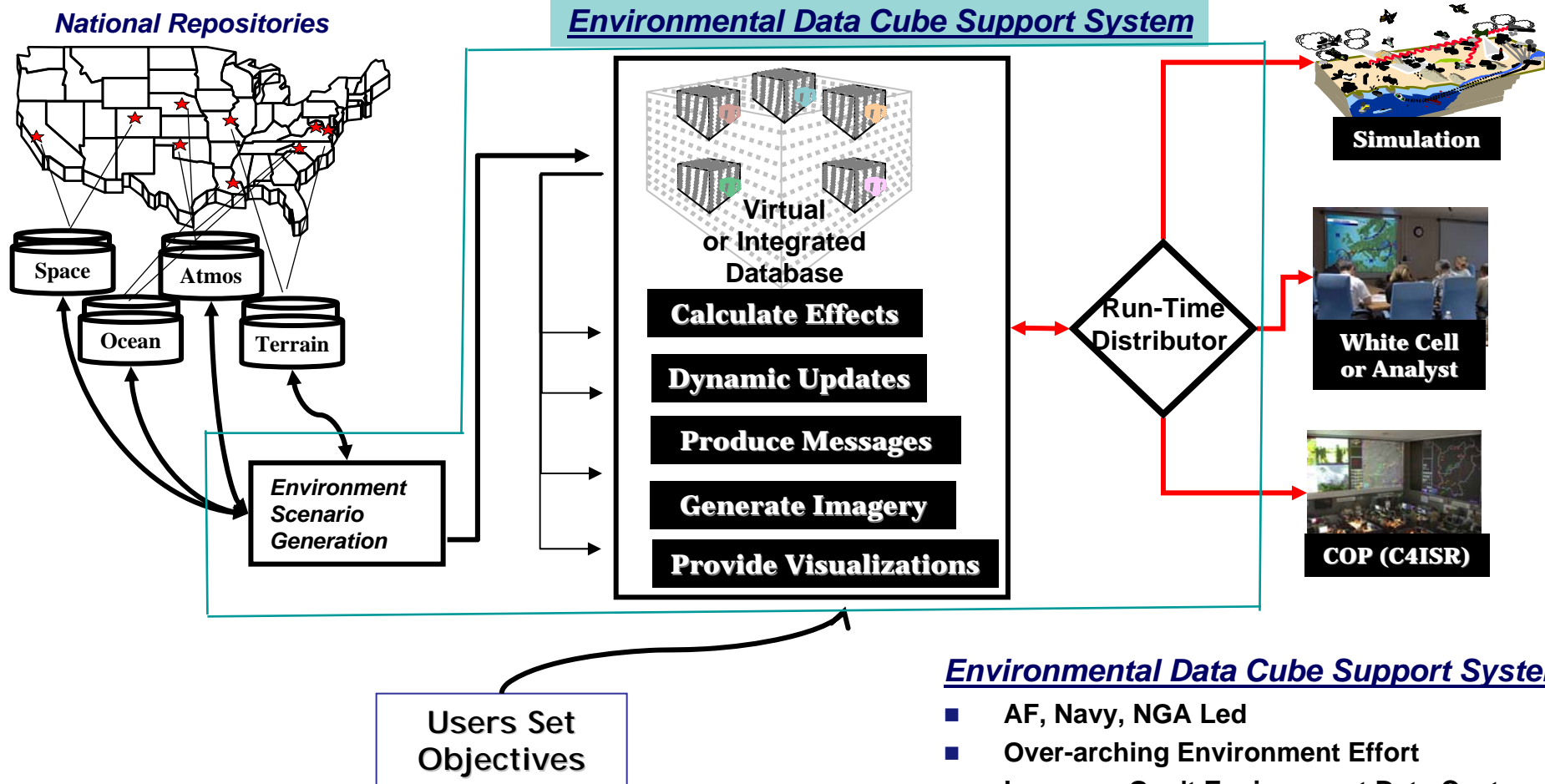
**Build & Tailor
Data**

#2

**Correlate
Products, Effects**

#3

**Distribute
Live, Virtual, Constructive**





Summary

- Realistic M&S requires high-fidelity, consistent, and relevant multi-domain environment representations
- The INEARP provides the roadmap. The ESG and SEDRIS are two key enabling technologies
 - National data and modeling assets provide the content
- The ASNE MSEA is working with the Ocean and Terrain MSEA's to realize the full INEARP vision



DoD ASNE MSEA Contact Info

Col Mark Zettlemoyer, A3O-W
703-696-4936
Mark.Zettlemoyer@pentagon.af.mil

Lt Col Allen Rabayda
703-696-4786
Allen.Rabayda@pentagon.af.mil

Maj Jim Everitt
828-271-4209
James.Everitt@afccc.af.mil

Additional information also available at <https://ine.aer.com>
